

THE CLAIMS

What Is Claimed Is:

5 1. An effluent gas stream treatment system, comprising:

means for pre-treating the effluent gas stream, to enhance its character for subsequent oxidation treatment;

10 an oxidation unit for oxidizing at least a portion of the oxidizable components of the effluent gas stream to abate such oxidizable components;

15 means for post-oxidation treatment of the effluent gas stream, to enhance the character of the effluent gas stream for discharge from the treatment system.

20 2. An effluent gas stream treatment system according to claim 1, comprising a gas stream inlet structure for shrouding the effluent gas stream with a liquid or gas shrouding medium.

25 3. An effluent gas stream treatment system according to claim 2, wherein the shrouding medium comprises a gas.

4. An effluent gas stream treatment system according to claim 2, wherein the shrouding medium comprises a liquid.

25 5. An effluent gas stream treatment system according to claim 2, wherein said inlet structure comprises a gas/liquid interface structure for transport of the effluent gas stream from an upstream source of same to a downstream processing unit, said gas/liquid interface structure comprising:

a first vertically extending inlet flow passage member having an upper entrance for introduction of said gas stream and a lower end for discharge of said gas stream;

5 a second flow passage member circumscribing the first flow passage member and in spaced relationship thereto, to define an annular volume therebetween, said second flow passage member extending downwardly to a lower end below the lower end of the first flow passage member, and said second flow passage member having an upper liquid-permeable portion elevationally above the lower end of the first flow passage member and a lower liquid-impermeable portion below said upper liquid-permeable portion;

10 an outer wall member enclosingly circumscribing the second flow passage member and defining therewith an enclosed interior annular volume; and

15 a liquid flow inlet port in the outer wall member for introducing liquid into the enclosed interior annular volume between the second flow passage member and the outer wall member.

20 6. An effluent gas stream treatment system according to claim 5, wherein the upper liquid-permeable portion of the second flow passage member comprises a porous cylindrical wall member.

7. An effluent gas stream treatment system according to claim 6, wherein the porous cylindrical wall member is formed of a sintered metal material.

25 8. An effluent gas stream treatment system according to claim 5, wherein the upper liquid-permeable portion of the second flow passage member is formed of a porous ceramic material.

9. An effluent gas stream treatment system according to claim 5, wherein the liquid-permeable portion is constituted by a porous wall having an average pore size in the range of from about 0.5 to about 30 microns.
- 5 10. An effluent gas stream treatment system according to claim 5, wherein the first and second flow passage members are each cylindrical in character and coaxial with one another.
- 10 11. An effluent gas stream treatment system according to claim 5, wherein the outer wall member enclosingly circumscribing the second flow passage member comprises a cylindrical sidewall in radially spaced relationship to the second flow passage member, a top end wall through which the first liquid flow passage member extends, and a bottom end wall between the second flow passage member and the sidewall of the outer wall member.
- 15 12. An effluent gas stream treatment system according to claim 2, wherein the inlet structure comprises a clog-resistant inlet structure for introducing a particulate solids-containing fluid stream to a treatment unit in said effluent gas stream system, said inlet structure comprising:
- 20 first and second generally vertically arranged flow passage sections in serial coupled relationship to one another, defining in such serial coupled relationship a generally vertical flow passage through which the particulate solids-containing fluid stream may be flowed, from an upstream source of the particulate solids-containing fluid to the treatment unit in fluid stream-receiving relationship to the inlet structure;
- 25 said first flow passage section comprising an upper section of the inlet structure and including an inner gas-permeable wall having an interior surface bounding an upper part of the flow passage, and an outer wall enclosingly surrounding the gas-permeable wall to define an interior annular volume therebetween;

5 a low pressure gas flow port in the outer wall of the first flow passage section, said low pressure gas flow port being coupleable to a source of low pressure gas for flowing of low pressure gas at a predetermined flow rate into the interior annular volume, for subsequent flow of low pressure gas from the interior annular volume into the flow passage of the inlet structure;

10 a high pressure gas flow port in the outer wall of the first flow passage section, said high pressure gas flow port being coupleable to a source of high pressure gas for flowing of high pressure gas into the interior annular volume, to clean the gas-permeable wall of particulates depositing or forming thereon;

15 the second flow passage section being serially coupled to the first flow passage section, for flowing of particulate solids-containing fluid downwardly into the second flow passage section from the first flow passage section, said second flow passage including an outer wall having a liquid injection port therein, said second flow passage section outer wall being coupled with the first flow passage section, and an inner weir wall in spaced apart relationship to the outer wall to define an interior annular volume therebetween, with the inner weir wall extending toward but terminating short of the gas-permeable wall of the first flow passage section, to provide a gap therebetween defining a weir, and with said weir wall having an interior surface 20 bounding the flow passage in the second flow passage section;

25 whereby when liquid is flowed into the interior annular volume between the outer wall of the second flow passage section and the inner weir wall thereof, the introduced liquid overflows the weir and flows down the interior surface of the inner wall of the second flow passage section to wash any particulate solids from the wall and to suppress the deposition or formation of solids on the interior surface of the inner weir wall, as the particulate solids-containing gas stream is flowed through the flow passage of the inlet structure.

13. An effluent gas stream treatment system according to claim 12, wherein a source of low pressure gases is coupled to the low pressure gas port in the outer wall of the first flow passage section.

5

14. An effluent gas stream treatment system according to claim 12, wherein a source of high pressure gas is coupled to the high pressure gas port in the outer wall of the first flow passage section.

卷之三

15. An effluent gas stream treatment system according to claim 12, wherein a lower end of the second flow passage section is joined to a water scrubber for scrubbing of the particulate solids-containing gas stream flowed through the flow passage of the inlet structure.

16. An effluent gas stream treatment system according to claim 12, wherein the first and second flow passage sections are quick disconnectably coupled to one another.

17. An effluent gas stream treatment system according to claim 12, wherein the first flow passage section is of cylindrical shape.

- 20 18. An effluent gas stream treatment system according to claim 12, wherein the first flow
passage section and second flow passage section are coaxially aligned with one another.

19. An effluent gas stream treatment system according to claim 12, wherein the gas permeable wall is formed of a porous metal material.

25

20. An effluent gas stream treatment system according to claim 12, wherein the gas permeable wall is formed of a porous ceramic.

21. An effluent gas stream treatment system according to claim 12, wherein the gas permeable wall and outer wall of the first flow passage section are of circular cross-section.
- 5 22. An effluent gas stream treatment system according to claim 12, wherein the outer wall and inner weir wall of the second flow passage section are of circular cross-section.
- 10 23. An effluent gas stream treatment system according to claim 12, wherein the first flow passage section is joined to an upstream particulate solids-containing gas stream supplying means.
- 15 24. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation unit comprises a scrubber.
- 20 25. An effluent gas stream treatment system according to claim 24, wherein the scrubber is a wet scrubber.
26. An effluent gas stream treatment system according to claim 24, wherein the scrubber is a dry scrubber.
27. An effluent gas stream treatment system according to claim 24, wherein the scrubber comprises a wet scrubber tower in which the effluent gas stream is contacted with an aqueous wash medium.
- 25 28. An effluent gas stream treatment system according to claim 27, wherein the aqueous wash medium is water.

29. An effluent gas stream treatment system according to claim 27, wherein the aqueous wash medium comprises a chemical reactant.

30. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation 5 unit comprises a gas inlet structure in which the effluent gas stream at its introduction to the pre-oxidation unit is passed through a gas-shrouding structure.

31. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation treatment unit comprises a scrubbing tower including an upper portion having a spray nozzle 10 disposed therein for introduction of aqueous wash medium into the scrubber tower, with a demister structure in the upper portion of the tower, overlying the spray nozzle.

32. An effluent gas stream treatment system according to claim 1, comprising a gas-shrouding 15 inlet structure upstream of the oxidation unit.

33. An effluent gas stream treatment system according to claim 1, further comprising a liquid- 20 shrouded gas transport structure downstream of the oxidation unit.

34. An effluent gas stream treatment system according to claim 1, further comprising a 25 quench unit between the oxidation unit and the post-oxidation unit.

35. An effluent gas stream treatment system according to claim 34, wherein the oxidation 20 unit, quench unit and post-oxidation unit comprise a unitary structure with respect to the gas flow path therethrough.

36. An effluent gas stream treatment system according to claim 1, wherein the post-oxidation 25 treatment unit comprises a wet scrubber tower, having at an upper portion thereof a spray

nozzle for discharging a scrubbing medium therethrough, for countercurrent contacting with the effluent gas stream.

37. An effluent gas stream treatment system according to claim 36, wherein the post-
5 oxidation scrubber tower comprises a packing therein, for enhanced gas/liquid contacting.

38. An effluent gas stream treatment system according to claim 36, wherein the post-
oxidation scrubber tower comprises a demister structure above the nozzle in the upper portion
thereof.

10 39. An effluent gas stream treatment system according to claim 31, wherein a quench unit is
arranged downstream of the oxidation unit, said quench unit comprising means for introducing a
quench medium for cooling of the effluent gas stream from the oxidation unit.

15 40. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation
unit and the post-oxidation unit each comprise a wet scrubber, wherein each of the wet scrubbers
comprises a sump reservoir for collection of contacted liquid, and a reservoir joined in liquid flow
receiving relationship to the sump reservoirs, for collection of contacted liquid from the wet
scrubber units.

20 41. An effluent gas stream treatment system according to claim 1, comprising a quench unit
downstream of the oxidation unit, with means for recycling a saturated water stream from the
quench unit to the oxidation unit, for oxidation of perfluorocarbons in the oxidation unit.

25 42. An effluent gas stream treatment system according to claim 1, wherein the oxidation unit
comprises an electrothermal oxidation apparatus.

43. An effluent gas stream treatment system according to claim 1, wherein the oxidation unit comprises a flame-based oxidation apparatus.
44. An effluent gas stream treatment system according to claim 1, wherein the oxidation unit 5 comprises a fluidized bed thermal oxidizer apparatus.
45. An effluent gas stream treatment system according to claim 1, wherein the oxidation unit comprises a heat exchanger.
46. An effluent gas stream treatment system according to claim 45, wherein the heat 10 exchanger comprises a heat transfer enhancement insert in a fluid passage thereof.
47. An effluent gas stream treatment system according to claim 1, wherein perfluorocarbons 15 are recovered upstream or downstream of the oxidation unit.
48. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation unit, oxidation unit and post-oxidation unit are contained in a unitary cabinet structure.
49. An effluent gas stream treatment system according to claim 1, comprising a fluid motive 20 driver downstream of the post-oxidation treatment unit.
50. An effluent gas stream treatment system according to claim 49, wherein the fluid motive driver comprises a pump.
- 25 51. An effluent gas stream treatment system according to claim 49, wherein the fluid motive driver comprises an eductor.

52. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation treatment unit comprises means for addition of chemical to the effluent gas stream, to reactively form a reaction product with elevated solubility for scrubbing removal thereof, and the effluent gas stream subsequent to such chemical addition and reaction is subjected to wet scrubbing.

5

53. An effluent gas stream treatment system according to claim 1, wherein the pre-oxidation unit comprises a U-shaped housing including first and second leg portions thereof joined to one another by a transverse yoke portion, wherein the first leg portion includes water spray means for contacting the effluent gas stream with sprayed water to reduce acidity and entrain particulates of the effluent gas stream, the second leg portion includes water spray means for further contacting the effluent gas stream with sprayed water, and the transverse yoke portion constitutes a collection reservoir for water sprayed into contact with the effluent gas stream in the first and second leg portions.

10
15
20
25

54. An effluent gas stream treatment system according to claim 1, wherein the oxidation unit comprises a transpirative oxidation unit.

20

55. An effluent gas stream treatment system according to claim 1, wherein the pre-treating means comprise a wet scrubbing unit upstream of the oxidation unit for controlling particulate formation in the oxidation unit by scrubbing effluent gas stream components which are particle-forming agents under the conditions existing in the oxidation unit.

25

56. An effluent gas stream treatment system according to claim 2, wherein the inlet structure comprises a clog-resistant inlet structure for introducing a particulate solids-containing fluid stream to a treatment unit in said effluent gas stream system, said inlet structure comprising a generally vertically arranged flow passage, for flowing of particulate solids-containing fluid downwardly therethrough, said flow passage including a bounding wall having a weir opening

therein, and an annular liquid supply reservoir circumscribing and in liquid feed relationship to the weir opening, with means for supplying liquid to the annular liquid supply reservoir for flow through the weir opening;

5 whereby when liquid is flowed into the annular liquid supply reservoir, the introduced liquid flows through the weir opening and flows down the bounding wall of the flow passage to wash any particulate solids from the wall and to suppress the deposition or formation of solids on the interior surface of the bounding wall, as the particulate solids-containing gas stream is flowed through the flow passage of the inlet structure.

10 57. An effluent gas stream treatment system according to claim 56, further comprising means for gas shrouding a portion of the bounding wall above the weir opening.

15 58. An effluent gas stream treatment system according to claim 1, further comprising a quench unit for cooling the effluent gas stream discharged from the oxidation unit.

20 59. An effluent gas stream treatment system according to claim 58, wherein the quench unit is constructed and arranged to contact the effluent gas stream discharged from the oxidation unit with a caustic solution to effect silica particle removal from the effluent gas stream.

60. An effluent gas stream treatment system according to claim 1, further comprising a wet electrostatic precipitator for flume/plume control.